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American
GAS JOURNAL
Formerly American Gas Light Journal
EST. 1859

VOL. CXIV. No. 201
WHOLE NO. 3298

NEW YORK, SATURDAY, MAY 21, 1921

Subscription $3 per year
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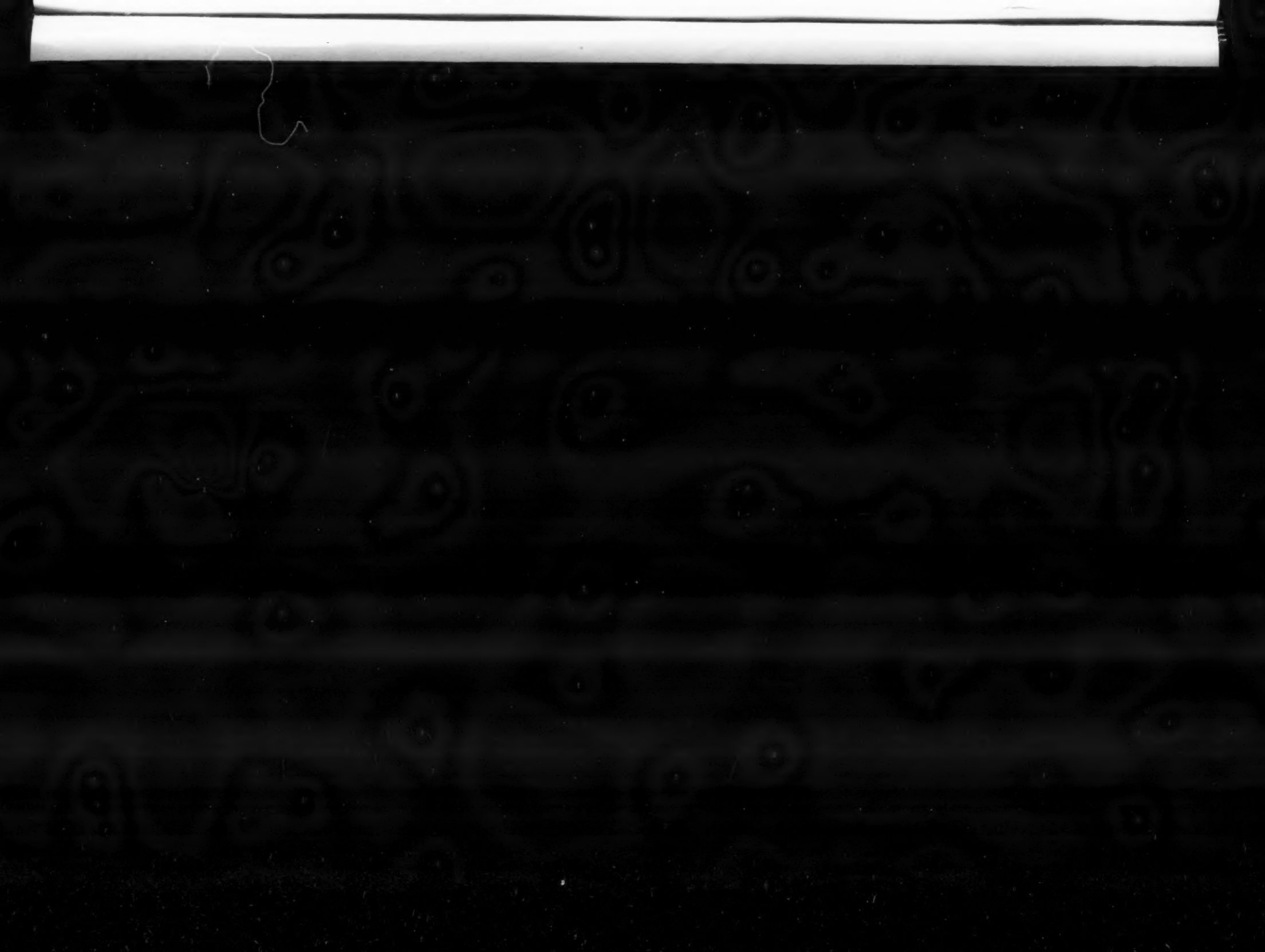
AMERICAN GAS JOURNAL. May 21, 1921. Vol. CXIV, No. 21. Published Weekly by American Gas Light Journal, Inc., New York, N. Y.
Subscription Price $3 per Year; $4 Canada; $5 Foreign.
Entered as second-class matter Jan. 9, 1917, at the post-office at New York, N. Y., under the Act of March 3, 1879.



American Gas Journal
Formerly American Gas Light Journal

Vol. CXIV, No. 21 NEW YORK, MAY 21, 1921 Whole No. 3298

Ancestor Worship

Just Another Name for Traditions

By J. H. VERNON

We are inclined to connect ancestor worship with such backward countries as China. It is generally accepted that one of the greatest drawbacks to the progress of China is ancestor worship. It has a strong tendency to make the people of China look upon all new ideas and all new methods as the work of the devil. Such things were not known by their ancestors. They were not used. Therefore, they cannot be good. A man who has spent many years teaching in China tells a story which brings out one result of this worship. In the interior of China an American engineer had charge of a mine. In order to increase production and lower the cost of operation it was necessary to use a locomotive to transport materials and supply from the nearest navigable waterway. The distance to the canal from which and to which material was being transported by carts and coolies was not great. A rail line was laid and a locomotive ordered. When it arrived it was assembled but no sooner was it put into operation than the story spread over the country that this company had a demon at the mine. In the course of time some of the Government officials heard the rumor and a committee was appointed to investigate. It was evident that if this committee, no member of which had ever seen a locomotive work, saw this one it would be condemned and would have to be destroyed. However, this engineer heard of the committee before it arrived and buried the offending machine in the sand. The committee investigated, found everything ship shape and reported accordingly. From that time on the company was able to use its locomotive. Gradually, but very gradually indeed, the idea of using railroads is permeating the Chinese population but in the meantime they are starving from farming, for, according to the statement of the men who have lived in China and studied the situation, the famine suffering in China is due more to the lack of a good railroad system for the whole country than to anything else.

Americans pride themselves upon their progressiveness and are inclined to look with more or less contempt upon a nation which will allow ancestor worship to bring it to such a state. It is true that the American nation as a whole is progressive. Yet we have in this country a number of very old industries that are being held back from the progress that could be made by this very ancestor worship.

When we first read this article we were of the opinion that it was too strong; that the gas industry would never accept it. In other words, that we would start a row. But on second thought we decided that constructive criticism is good for all of us. So here it is. We shall be sorry for anyone who can't accept it in the spirit in which it is offered.—Editor.

Tradition a Misnomer

We call it traditions, precedents or by some other name, but when the subject is analyzed and the cause sifted right down to the nuggets we find that in principle at least it is no different from the ancestor worship of the Chinaman. Let a man suggest some entirely new ideas to some of the older men in these industries. Let him propound theories that have proved successful in some newer and more progressive industry. What happens to him? He is looked upon with suspicion. He is considered either as being a fool or being possessed with a demon. The sooner he can be encouraged to leave the industry and enter some other the happier the old-timers and all those who are saturated with the traditions of the industry. It is really not much different from China after all.

A very eminent educator gives it as his conviction that the reason for the great progress made by the electrical men during the past forty years is that they have not been hampered by traditions. They have had no precedents to go by. They have had to work from fundamental principles and from theory. They could not do things the way they have been done by their ancestors for the reasons that they had no ancestors who were electrical engineers. The result has been a constant trying of new things, a reaching out

into new fields. In mechanical engineering there are traditions to go by. The result is less progress in the use of materials and design than in the electrical field. As a matter of fact, it was not so many years ago when the mechanical engineer looked upon the methods of the electrical man with more or less scorn. The man in the electrical field was not following traditions even when it came to the point where he was encroaching to a certain extent upon the mechanical field. As a matter of fact some very radical changes have been made in certain fields covered by mechanical engineering by the electrical men who, being unhampered by tradition, have worked from fundamental principles.

The Weakness of the Gas Industry

From all this it can be seen that the greatest weakness of the gas business lies in its traditions. There is too great a temptation to force the men with new ideas and new methods to bury these in the sand just as those Chinese forced that American engineer to bury his locomotive in the sand. The gas industry is now facing the most serious conditions it has ever faced because it has worshipped traditions.

It has not developed the by-product field to as great and as intensive a degree as it might have been developed because it simply wasn't being done. It has not adopted a scientific basis of rates the way that the central stations have because it was discovered that there were a lot of reasons why it would be hard or impossible to put them into force. Beneath all these reasons, however, were traditions. It never had been done so why should it be done. As a result while central stations in some cases have been able to make money during the industrial depression through which we are passing, the gas company has found it very hard if not impossible to meet expenses.

Yet for the past fifteen years the more progressive men in the industry have been preaching the very things, the very methods, the very improvements that if adopted would have made this industrial depression a matter of little concern to the gas industry. Ancestor worship is the cause of the present troubles of the gas industry just as truly as it is the cause of the starvation that is taking place in the interior parts of China.

Just as the Chinaman was inclined to look upon the locomotive as a dragon, a demon, so the gas man has been inclined to look upon new and progressive methods that have never before been used in the industry. Just as the Chinese have allowed many of their canals to be clogged with silt so has there been a tendency in some quarters to allow methods that have worked well in the industry to become clogged with red tape.

A Wrong Idea

The idea that the big company is always right and the little one wrong, that the old man in the industry is always wise and the new man always foolish, is a very dangerous one to which to cling. No one for a moment who is in his right senses would say that Russia is a better country than this one of ours. Yet Russia is a larger country than ours. No one would say that China is more progressive than the United States, yet China was thousands of years old before the first white settlers came to our shores.

It is not where the ideas come from that count but how good they actually are. There are men who have recently come into the gas industry. Men who have spent the greater part of their lives in other fields but who perhaps through chance have come into possession of a gas company or so. These men know nothing about the traditions of the gas industry. They are inclined to apply to the gas business the same principles that they have found successful in other lines. Often they have excellent ideas that can be adopted to advantage by many other companies. Yet these men are new in the industry and often their properties are small. The man who holds the traditions of the industry close to his heart is bound to frown upon these interlopers and their ideas.

This is surely a mistake. Even China has come to the point where she is glad to accept aid and advice from that nation which compared to China is still in swaddling clothes. She is accepting this from that callow nation, the United States, that has broken all traditions and seems at least in the past to have little regard for ancestors.

Must Accept New Ideas

The gas industry is rapidly approaching the position where it like China will have to look for and accept new ideas. Worshipping traditions has already cost millions of dollars. Much more worship of this sort is bound to result in costs that reach billions. New rates new methods of selling appliances, gaining more profits from by-products; these are problems that must be solved at once. The youthful electric industry has already solved the first two problems and their solutions are easily adaptable to the gas industry. Refusing to use them because they are the development of electrical men will not help matters. That is, it will not help the gas industry. It may mean less competition for the electrical man. But after all, competition is the life of trade. It keeps every one on his toes. It means the greatest progress.

The development of the chemical industry calls for broad-minded and unselfish co-operation on the part of the gas man. If he gives this, if he does all that he can do to develop this industry, he is going to develop a greater and a more profitable field for by-products. It is just a case of casting off traditions as did our forefathers in 1776 and making the industry a better one for our children and our children's children. Now is the time when we must look to the future rather than the past.

Harding Starts Natural Gas Convention

Cincinnati, Ohio.—The 2,000 delegates to the convention of the Natural Gas Association of America cheered as a miniature gas derrick erected on the stage began to operate when President Harding pressed a button at the White House. Another push of the button by the President set an electric fan in operation and the wind from it waved a flag which was set in a horseshoe of flowers.

I. V. Brumbaugh, gas engineer for the United States Bureau of Mines, told the gathering that expert estimates of the wastage of natural gas annually for domestic purposes was 150,000,000,000 cu. ft. which, if replaced with artificial gas would cost $1.25 a thousand or a total of $187,500,000 for one year and $375,000,000 for two years. He urged conservation through changes in gas appliances.

The Analysis of Sulphur Forms in Coal

Tests Made Under Direction of U. S. Bureau of Mines

By ALFRED R. POWELL

Methods for the analysis of total sulphur in coal have been in use for many years and at the present time are so numerous that it would be folly to attempt to describe all of them. All depend on the general principle of complete oxidation of the coal, followed by estimation of the sulphates produced by this process. From a technical standpoint a total sulphur determination is useful as indicating one of the factors which fix the value of particular coals for use under steam boilers, for general heating, and for the manufacture of coke and gas.

For certain purposes, however, it is desirable to know not only the total sulphur content, but also how the sulphur is combined in the coal and the exact amount of each form present. Data of this kind would be useful in indicating how much of sulphur-containing material can be removed from the coal by washing processes, what effect the sulphur has on the heating value of the coal, how the various sulphur forms behave during the coking and gas-making processes, and other facts of interest to coal technologists.

Recently at one of the State conventions the question of determining the sulphur content of coal came up and the wish was expressed that some authoritative information could be secured. With this in mind, the "American Gas Journal" has secured permission from the Bureau of Mines to reprint this excellent paper by Mr. Powell. We believe our readers will be greatly interested in it.—Editor.

The main purpose of this investigation, undertaken by the Bureau of Mines, however, was to try out further the method of Powell and Parr for the analysis of sulphur forms in coal (described in this article), to determine its applicability to a variety of coals, and to introduce, if necessary, certain refinements of analysis. Preceding experiments had been chiefly with Illinois coals, so it was important to ascertain just how the method would apply to coals from other districts.

Acknowledgments

The author wishes to express his appreciation to A. C. Fieldner, under whose direction this investigation was conducted, for many valuable suggestions; to Prof. S. W. Parr for his constant interest in the coal sulphur problem and his advice and direction during the earlier stages of the work at the University of Illinois; and to E. A. Holbrook, who was the pioneer in stressing the importance of the problem of coal sulphur in its economic relation to the nation.

Iron pyrites has been known as one of the constituents of coal for a great many years and investigators have had fairly good evidence that sulphur in organic combination also existed in coal. The first method proposed for the analysis of these two forms utilized sodium hypobromite. The supposition was that the hypobromite dissolved the pyrites and sulphates without affecting the organic sulphur, but no proof was advanced to show that this was correct.

The action of bromine on coal sulphur was investigated and the conclusion reached that there was no selective solution of pyrites, but that some of the organic sulphur was taken into solution. This was shown by variations in the iron-sulphur ratio of the extract from that corresponding to FeS_2.

A method depending on on certain assumptions regarding coal sulphur has been used in recent years. The total iron in the coal minus any water soluble iron that may be present is considered to be iron combined as pyrites. From this is calculated the sulphur existing as pyrites. Any sulphur present as sulphate may be determined by a simple extraction with dilute acid; then the pyritic sulphur plus the sulphate sulphur when subtracted from the total sulphur gives the sulphur organically combined, provided no other form of sulphur exists in the coal. This method is faulty in that it disregards the presence of iron silicate and that the whole procedure is based on unproven assumptions regarding combinations of sulphur in the coal.

A method somewhat more satisfactory than the foregoing was devised by the Bureau of Mines in 1914, the work being done under the direction of A. C. Fieldner and F. D. Osgood. A large number of analyses were subsequently run on coals from various parts of the country in order to get an idea as to the organic sulphur content of coals from different districts.

In this process the coal is crushed to pass a ten-mesh screen and then sifted over a sixty-mesh screen. The fine material is discarded and that remaining on the sixty-mesh screen used for the analysis. This material is treated with a zinc chloride solution of 1.35 specific gravity, so that the heavy ash-containing material could sink. The coal substance remaining at the top of the solution contains only a few tenths of 1 per cent of iron, the remainder being carried

down in the ash. This lighter fraction of the coal is then washed with dilute acid to remove sulphates or soluble iron compounds and the iron considered to be combined as pyrites. From this the sulphur combined as pyrites can be figured and the difference between it and the total sulphur in the coal fraction is taken as the organic sulphur.

This method is only fairly accurate for several reasons. To begin with, discarding the sixty-mesh coal gives an unrepresentative sample. A small part of the organic sulphur might be carried down with the heavy fraction and the iron remaining in the lighter fraction might not be entirely combined as pyrites, since some of it may be present as iron silicate, for example. Furthermore, proof is lacking at this time that the sulphur assumed to be organic is actually so combined. Later experiments have proved, however, that this method is fairly accurate for organic sulphur, and the data thus obtained show that organic sulphur is present in most coal to a much greater extent than generally supposed.

Powell and Parr Method

An accurate analytical method for the systematic analysis of sulphur forms in coal has been developed within recent years by A. R. Powell and S. W. Parr. This may be described briefly as follows: Five-gram samples of the finely divided coal are taken for the sulphate analysis. These are extracted with 3 per cent hydrochloric acid at 60 deg. Cent. for a period of forty hours. The extract is analyzed for iron and sulphur, the sulphur representing the sulphate sulphur present in the coal.

For the pyrite analysis one-gram samples are extracted with 80 c. c. portions of dilute nitric acid, specific gravity 1.12, for a period of twenty-four hours at room temperature. The extract is evaporated to dryness, taken up in hydrochloric acid, and analyzed for iron and sulphur. This sulphur represents the sulphur as pyrites plus the sulphur as sulphate. The latter form has already been determined, so by subtraction the pyritic sulphur content of the coal is given. This amount may then be checked to prove that it is the pyrite sulphur by the following calculation: The hydrochloric acid soluble iron is subtracted from the nitric acid soluble iron, thereby giving the iron combined as pyrites. By a simple stoichiometrical calculation the sulphur combined with the iron is obtained, and this should agree with the sulphur previously determined as pyritic sulphur. In the case of every coal tried these two figures checked, showing that the method is accurate for the pyritic sulphur.

That the remainder of the coal sulphur is organic is proved as follows: Phenol will extract a large quantity of material from coal, this extracted substance having a great influence on coking quality. The phenol soluble material is ashless and, therefore, organic. A portion of the coal sulphur is found in this extract, but not enough to account for all of the organic sulphur.

After the coal has been extracted with phenol the residue is treated with dilute nitric acid to remove the inorganic sulphur. After nitric acid treatment the coal forms a dark colloidal solution with ammonia, which may be filtered, leaving on the filter most of the ash and inorganic matter of the coal. The colloidal material of the filtrate is very low in ash, showing that inorganic substances are practically absent. This material is found to contain the remainder of the coal sulphur, which must be in an organic form, since it occurs in an organic fraction of the coal.

This method of analysis not only determines the inorganic sulphur forms directly, but also gives a method of proving that the remainder of the sulphur is organic—the first absolute proof that organic sulphur exists in coal in comparatively large quantities.

Description of Coals Used in Experiments

The coals analyzed by Powell and Parr were gathered principally from Illinois fields. It was decided, therefore, to run similar analyses of coals from other fields in order to determine the applicability of this method to coals of other districts. A small number of coals only was selected for these experiments, since the detailed study required considerable time for analyzing each coal. Furthermore, it was preferable to get samples which had stood some time so that there would be an appreciable amount of sulphate present, as in freshly mined coal this form of sulphur is usually very small in quantity. The following table gives a detailed description of each coal used:

Table 1—Sources of Coals Used in Experiments

Laboratory Number of Sample	State	County	Post-Office	Mine and Bed	Company Operating Mine
23066.....	Pennsylvania	Butler	Chicora	Chicora, Upper Freeport.	Cunningham Coal Co.
18847.....	Pennsylvania	Allegheny..	Bruceton ...	Experimental, Pittsburgh.	U. S. Bureau of Mines
20507.....	West Virginia	McDowell .	Switchback ..	Mine No. 7, Pocahontas No. 3	Pocahontas Fuel Co.
21308.....	Kentucky	Letcher ...	Fleming	Mine No. 301, Elkhorn...	Elkhorn Coal Corp.
21100.....	Tennessee ...	Morgan ...	Coalfield	Conger, Coal Creek.....	Conger-Baker Co.
27224.....	Kansas	Cherokee ..	West Mineral	Katy No. 9, Cherokee....	Mayer Coal Co.

Methods Used in Experiments—Total Sulphur

Total sulphur determinations were made on each coal by the sodium peroxide method as used by Powell and Parr. The results obtained by this method were very irregular, and investigation revealed that blank determinations on the sodium peroxide showed large quantities of sulphur which were not constant in amount for different portions of the same batch. Furthermore, the nickel crucibles were attacked by the hot, alkaline fusion to such an extent that some nickel was occluded by the barium sulphate in the final precipitation.

These difficulties led to the adoption of the Eschka method for determining sulphur in coal, and this was used not only in the determination of total sulphur but also for the sulphur in coal residues, throughout the investigation. The percentage of total sulphur in the coal as well as the percentage of the different

sulphur forms is all figured on the basis of the air-dried coal.

Sulphur as Sulphate

The analysis for the sulphate content was performed by the method used by Powell and Parr. Five-gram samples of the coal were extracted with 300 c.c. of 3 per cent hydrochloric acid for forty hours. The beakers in which the extraction took place were kept over a water bath so as to be maintained at a temperature of about 60 deg. Cent. The contents were then filtered and the filtrate analyzed for iron and sulphur. The Zimmermann-Reinhardt potassium permanganate titration method was used to determine the iron, and the sulphur was determined by the usual barium sulphate precipitation.

Sulphur as Pyrites

For the pyrite analysis one-gram samples of the coal were allowed to stand with 80 c.c. portions of dilute nitric acid, specific gravity 1.12, for two or three days at room temperature. Twenty-four hours is probably sufficient for this extraction, but a longer time does no harm. If a shaking machine is available, the extraction time may be cut down materially.

The extract was then filtered off and the nitric acid evaporated on the water bath. The residue from this evaporation was taken up in hydrochloric acid and the resulting solution analyzed for iron and sulphur by the methods described above.

The iron obtained in the nitric acid extract represented that extracted by the hydrochloric acid plus the iron combined as pyrites; therefore the pyritic iron could be figured by the difference between the two iron determinations. The sulphur in the nitric acid extract represented the sulphate sulphur, which had been determined previously by hydrochloric acid treatment, plus the sulphur combined as pyrites. Moreover, if the dilute nitric acid were taking into solution any of the organic sulphur, it would have appeared in this extract. The question as to whether any of the organic sulphur was being taken into solution by the nitric acid could be answered by comparing the percentage of pyritic iron with what was presumably the percentage of pyritic sulphur. This latter was obtained by subtracting the percentage of sulphur as found in the hydrochloric acid extract from that in the nitric acid extract. If the pyritic iron and the sulphur were in the exact proportions to form FeS_2, the nitric acid was a selective solvent for pyrites in that particular coal. If the sulphur were in excess, however, the indications would be that the organic sulphur of that coal was being attacked by the dilute nitric acid. It was by these calculations that the accuracy of the method for pyritic sulphur was checked.

Sulphur in Organic Combination

The amount of sulphur in organic combination was determined by much the same means used by Powell and Parr in their previous investigation. The phenol soluble type of organic sulphur was calculated from the difference between the total sulphur content of the coal and the sulphur content of the coal residue after phenol extraction.

The extraction of the coal by phenol was carried on in an oven, having a constant temperature of 150 deg. Cent. Air condensers were so arranged that the vaporized phenol would be carried back into the extraction flasks. One-half-gram samples of coal and 25 c.c. of phenol were placed in the flasks, and the extraction allowed to proceed for twenty hours. The contents were then filtered through a porcelain Gooch crucible and thoroughly rinsed with alcohol and ether. The entire asbestos mat, with its covering of coal residue, was ground up with the Eschka mixture, and the sulphur determination run in the usual manner. As stated before, the phenol soluble organic sulphur was obtained by difference. The phenol soluble organic sulphur was obtained by difference. The phenol soluble material was known to be organic because of its lack of ash.

The so-called "humus" type of organic sulphur—that very stable portion which is not extracted by phenol—was determined directly by a method differing slightly from that of Powell and Parr. The residues from the dilute nitric acid extraction, previously described, were used for these studies, since all of the inorganic sulphur had been removed, and all of the organic sulphur of the coal was present, unless the dilute nitric acid had extracted a little of the organic sulphur. This last possibility would have been determined at the time of the nitric acid extraction; thus it can be safely said that all of the organic sulphur was present in the nitric acid residue or had been accounted for otherwise. In most cases particularly where only a small amount is present, the phenol soluble sulphur will respond to the same treatment given the more stable humus organic sulphur; therefore the following method was used for the total organic sulphur determination. In the case of only one coal, where the phenol soluble sulphur was high,

(*Continued on page 454.*)

Table 2—Proximate Analyses and Calorific Values of Coals Used in Experiments*

Laboratory Number of Sample	Proximate Analysis					Calorific Value	
	Moisture Per Cent	Volatile Matter Per Cent	Fixed Carbon Per Cent	Ash Per Cent	Sulphur Per Cent	Calories	B.t.u.
23066	2.04	33.11	56.36	8.49	1.21	7,450	13,410
18847	1.57	38.72	54.95	4.75	1.72	7,901	14,222
20507	.39	22.88	70.47	6.25	.56	8,133	14,639
21308	1.65	37.78	56.57	3.98	.71	7,910	14,238
21100	.74	39.05	52.40	7.80	4.25	7,821	14,078
27224	1.73	34.90	55.14	8.23	3.06	7,559	13,606

*All samples were in an air-dry condition.

N. Y. Consolidated Gas Company Reduces Rates

Makes Voluntary Decrease Under Oil Price Decline

Announcement was made by the Consolidated Gas Company of New York following a meeting of the executive committee of its board of trustees, on May 17, that the company expects to be able to procure gas oil, after August 1, 1921, at a price of 6 cents per gallon, as compared with the present contract price of 12¼ cents per gallon, and that the Consolidated Gas Company will reduce its rates accordingly, on August 1, so as to give the consumers promptly the benefit of the reduced cost of gas oil. This will be done by the company, it was stated, notwithstanding the heavy losses incurred by the company during 1917 to 1920 under the inadequate rates then in force.

As approximately four gallons of gas oil are used in making a thousand cubic feet of gas in the proportions of mixed coal gas and water gas produced in the plants of the Consolidated Gas Company system, the decreased oil cost will mean that the $1.50 rate now being charged by the Consolidated Gas Company, the Central Union Gas Company and the Northern Union Gas Company, will be reduced, on August 1, to a $1.25 maximum "or such lower figure as operating costs at that time permit." The statement made in behalf of the Consolidated Gas Company also announced the policy with respect to gas companies not now charging rates deemed adequate. As to such of these companies as operate in outlying territory under special local conditions, any reduction as of August 1 will be determined by the operating costs of the particular company at that time.

The statement given out by George B. Cortelyou, the president of the Consolidated Gas Company, in behalf of that company and its subsidiaries, was as follows:

"In announcing on Feb. 18, 1921, the increase in the rate charged by the Consolidated Gas Company to $1.50 per thousand cubic feet, the statement was made in behalf of the company that although this increased rate was required by operating costs beyond the company's control, the $1.50 rate would be reduced just as soon and just as far as decreases in the cost of gas-making materials or labor permitted. It was stated that in so far as gas oil was concerned, a decrease in these costs could not be expected until the company had used the quantity of gas oil called for by its existing oil contract, designed to cover the company's oil requirements during the first six months of 1921, and that if gas oil could be procured, after July 1, at less than the present contract price of 12¼ cents per gallon, the company would make a new contract, at the best price obtainable, and reduce its rate for gas to the point then required for adequacy, in the light of such new oil price and other operating costs in force at that time.

"Negotiations for a new gas oil contract have now reached the point where the company is assured of an adequate supply of good oil at a price substantially below the present price. The quantity of oil contracted for last December, for the first six months of 1921, was based upon the requirements for the corresponding period in 1920. As a matter of fact, however, the unusually mild temperature prevailing during the winter of 1921 decreased substantially the quantity of oil used in those months. The total gallonage of oil called for by the present contract will, therefore, not have been consumed, according to present estimates of the company's engineers, until late in July, at which time a new price of 6 cents per gallon or thereabouts will become operative.

The action of the Consolidated Gas Company of New York in voluntarily making a substantial decrease in its rate is the best evidence in the world of the desire of this industry to protect consumers. Perhaps those who so viciously attack us will be silenced by this action of one of the largest utilities of the country.—Editor.

"As approximately four gallons of gas oil are used in making one thousand cubic feet of mixed coal and water gas in the proportions produced by the companies of the Consolidated system, this reduction of 6 cents per gallon in the cost of gas oil will enable a reduction in the rate charge for gas of approximately 25 cents per thousand cubic feet, other factors of operating cost remaining the same.

"Accordingly, the Consolidated Gas Company, the Central Union Gas Company, and the Northern Union Gas Company expect to be able to file with the Public Service Commission a new rate schedule putting into effect, as of Aug. 1, 1921, a rate of not more than $1.25 per thousand cubic feet, in place of the $1.50 rate now in effect.

"Since the putting into effect of the $1.50 rate there has been no material change in the prices paid for other gas-making materials and labor. The actual cost of manufacture and distribution, including return on the company's investment as computed by the court, slightly exceeds $1.50 per thousand cubic feet at the present

(*Continued on page* 458.)

American Gas Journal

SIXTY-FIRST YEAR

Published Weekly by AMERICAN GAS LIGHT JOURNAL, INC., 150 Nassau Street, New York, N. Y.

ELBERT P. CALLENDER, Pres. S. G. KRAKE, Vice-Pres.-Treas. A. M. GLEASON, Sec'y

WALTER A. FAIRSERVIS, Editor

Subscription $3.00 per year, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines; in Canada, $4.00; foreign, $5.00—Single Copies, 10 cents

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As the Journal Views It

Domination in the Gas Industry

The leading article this week, "Ancestor Worship," we feel sure, will create widespread comment. There are a lot of truths contained in it that may be unpalatable, but we believe they will be welcomed despite that.

One point that the author makes and which seems to us to be of especial significance is that big companies can and do make as many mistakes as do the smaller ones. This has long been a sore point in the gas industry, and it has been the habit of some of the larger companies to dominate a situation simply because as a matter of geography they are better situated than the smaller ones. But this attitude is all wrong; and if the article referred to will help to clear up this matter, then it will have accomplished a great deal.

One of the policies of some of the larger companies has been to fight some one action of a smaller organization on the basis that it would be contrary to the interests of the larger one, which, it was pointed out, must prevail. Now, the big fellows are as prone to make mistakes as the little fellows, and, as a matter of fact, have been known to make more. But these mistakes have been covered up, and if the little fellow has suffered as a result nothing has been said. This may be good business, but we can't find any justification for such an attitude. The rights of the smaller companies are just as sacred as those of the big ones, even if the investment is not so great, and these interests must be protected.

It must not be understood that all large companies are wrong simply because they are large. Such is not the idea. There are a great many large compa-

nies—we are happy to say they are in the preponderance—that use all of their powers to aid the smaller ones. But here and there, in isolated cases, we find some large company that recognizes no rights but its own, and not being content with this it attempts to force the other fellow to bow to its will. After all, the backbone of this country is not the large center but it is the smaller cities and towns, and the AMERICAN GAS JOURNAL feels that it owes much of its power and popularity to the support which has been given by the smaller companies. While it holds no briefs for any individuals nor for any group, feeling that its allegiance is to the gas industry as a whole, it will always protect the smaller company to the best of its ability.

While it is a bit foreign to the subject, it might also be well to point out that the AMERICAN GAS JOURNAL is independent, its policies are its own, and no individual, no matter what his claims may be to the contrary, has any particular "pull," nor can he influence our attitude on any subject in any way.

We hope that any decisions that a large company may attempt to influence will be made, in the last analysis, for the good of the industry, and not for individual profit.

The Supreme Court Decision

The decision of the United States Supreme Court in denying the right of the City of New York to intervene in a gas suit, which decision upheld the lower court, is simply another indication that short shrift is made of the question of politics when the Federal courts are involved. The action of the city was in line with its policy of contesting every right of a public utility, hoping thereby to influence the voter. But the number of decisions that have been rendered against this policy, both in the Federal and State tribunals, would discourage most of us; but not so the City of New York. It is persistent, to say the least, even though there is no public demand for any oppressive tactics.

Even though there was no opinion rendered with the decision, the verdict of the court is unmistakable and clear. It should clear the track in other litigation that will of necessity be brought by companies in fighting for their rights.

The Corporation Counsel of the City of New York in commenting on the decision declared that the city already was represented in the cases coming in, as he put it, "through the back door," but he desired that judicial recognition be given to his department in order that the city might "come in through the front door."

After all, perhaps a vote of thanks is due to the City of New York by public utility men generally for the contest which was carried on. The resulting decision will act as a precedent for future action and helps to clear up some confusion. But we still are of the opinion that there are many other ways in which the taxpayers' money can be used to much greater advantage.

Employees' Representation

There can be no doubt of the success of the employees' representation plan which has just gone into effect in the Peoples Gas Light & Coke Company, Chicago. When this plan was announced several months ago it attracted attention all over the country and was the subject of a great deal of editorial comment on the part of the big daily newspapers. It came at a time when the labor market had eased and it was evidence of the desire of one of the largest public utilities of the country to play fair with its employees.

Now that the plan has been perfected and has been placed in active operation, gas men will be interested in learning of its progress. There are many departures announced in its formation, and it is these that will be the center of interest.

That the Peoples Gas Light & Coke Company is on the right track none can gainsay. We predict that the effectiveness of that already effective organization will be increased and the spirit of the employees will back up the company in every move.

The plan comes as a climax of a campaign of education that this progressive company has been carrying on for some time. It has had an employees' magazine (incidentally, one of the most interesting that comes to our desk), an employees' organization that has been extremely active in promoting the welfare of the workers, and several other ventures that have had as an object the promotion of the well-being of the employees. Now comes the representation plan, and the details as announced are a conclusive indication that the plan will be successful. We shall hope that the workings will be made public so that other progressive companies will be guided in their decisions regarding the establishment of similar work. The AMERICAN GAS JOURNAL congratulates both the Peoples Gas Light & Coke Company and its employees.

Lowell Gas Company Keeps Strikebreakers

Lowell, Mass.—Workmen who have taken the places of striking employees of the Lowell Gas Light Company will be retained in the company's employ, General Manager Pritchard has stated.

Mayor Perry D. Thompson and Commissioner George G. Marchand, who visited the plant at the request of the strikers, were informed that the management "would keep its word" with the new men and continue them in its employ.

Employee Representation Plan Now in Effect

Peoples Gas Light & Coke Company Carries Out Scheme Recently Announced

Employee representation in the Peoples Gas Light & Coke Company is now formally and officially in effect. All of the fourteen departmental joint councils provided for in the constitution are organized and functioning. The general joint council (the supreme court as it were of the employees representation plan) will have its first meeting on May 19, 1921.

Employee representation was inaugurated with a meeting in the company dining room on Friday, April 29, which was attended by all of the elected and appointed members of departmental joint councils. In calling the meeting to order, B. J. Mullaney, manager of industrial relations, said:

"All members of the departmental joint councils have been asked to come here this afternoon so that you may look one another in the face and so realize that you are not merely parts of small groups but that each of you is part of a big, broad organization that has real work to do. With that in mind, President Insull has been asked to say a few words about this work."

Mr. Insull said:

"One of the great difficulties in connection with popular government is its inauguration—the starting of it. Most newly formed parties are inclined to try out all kinds of experiments. If you cast your eye over the United States, you will find that the older communities, representing the original thirteen colonies along the Atlantic Seaboard, are by far the most conservative and, on the whole, are the best governed. It is in the States where, but a short time ago, the prairie schooner was the means of transportation that you will find radical experiments.

"We are likely to have the same class of experience in giving effect to our belief that the employee has as much right to representation as the employer. Such efforts as we are making here are novel. Relatively few of them have been tried out except on a small scale. The most successful amongst experiments in employee representation are in the smaller places, where every employee knows his employer by his first name. Trying this experiment on a larger scale means that you are responsible for a great deal.

"You cannot accomplish, in your various councils, all that you want to in a day. You may want to try all kinds of experiments. Some of them, in all probability, will be mighty good suggestions. But my advice is to be conservative in your action. It is easy to get applause by radical propositions. Remember that only fools rush in where angels fear to tread. Weigh every proposition brought before you.

"The real success of this effort depends on how few of your propositions have to come up to me finally for decision. If I don't hear from the employees' representation plan for a whole year, I shall know that it has functioned properly and has been highly successful.

"Fair-minded men and women should be able to agree on the reasonableness of propositions coming before you. The whole basis of our system of government; the whole basis of justice, rests upon that theory. It is now up to you to show that, with power placed in your hands, you can act with conservatism and judgment; and if you do, you will be building a policy which will not only add to the success of yourselves and your fellows, but to the success of the organization that we all work for."

From all over the country came comments when the Peoples Gas Light & Coke Company, Chicago, announced the inauguration of the employees' representation plan. The details of organization having been successfully carried out, the plan goes into effect and, we are sure, will be watched with great interest.
—Editor.

The meeting unanimously recommended, on motion of P. C. MacDonald, that the secretarial needs of each departmental joint council be met by having one general secretary to serve all councils.

G. L. Harris of the bureau of commercial economics, which prepared the working draft of the employees' representation plan, was introduced and said:

"We of the bureau of commercial economics feel that this employees' representation plan has the best chance, of any employees' representation plan that we know of, to be a real success.

"You will be interested to know that this constitution of yours, in comparison with the many similar constitutions that have been adopted in this country, has passed one of the most favorable tests that we could ask for it. The original employees' representation plan was that of the International Harvester Company. Mr. Young, manager of industrial relations of the Harvester Company, has asked for 400 copies of this constitution for distribution in his company, because he feels that some points are covered here better than they are in other constitutions recently adopted.

"The bureau is extremely interested. We want to see this thing go. We are sure it will. We feel that

there is a family spirit here that will help make it go. I have never seen a large organization such as this that has so many friendly and pleasant happenings, and I think you people ought to be congratulated. Our work with you has been a real pleasure, and we certainly wish you all the luck in the world."

In closing the meeting, Mr. Mullaney said:

"When employee representation plans were new in this country they were frequently regarded as schemes to counteract labor unions. Later on when conditions changed, the attitude toward them frequently was that they were forerunners of efforts to decrease wages. Still later, when wages and salaries appeared to have reached the top and to be about to slide the other way, it was said that employees' representation plans were 'about through'—that there wouldn't be any more employee representation. In contradiction to all that, we of the Peoples Gas Light & Coke Company are going to have employee representation now. This should be to you a guaranty of the sincerity with which the company is inaugurating this plan.

"It will be a mistake if we treat these departmental joint councils, under employees' representation, as bodies for dealing only with complaints and grievances and grouches. If we don't get a broader view than that our plan will fail.

"Let us take up this work in the spirit of mutual helpfulness. Most controversies would disappear if the persons concerned would just meet around a table, put aside grouches and false pride and talk things over on the square. It is for us, who represent employees and management in this organization, to bring about here such a condition from discussion and harmonious decision.

"Our employee representation can be made a success. If it is a success, we will work better and easier, our compensation will be more satisfactory, and we will all get more out of the world in every respect. But it can be made a success only by the fullest degree of co-operation. Attainment of that is up to you members of the departmental joint councils. I cannot make this plan go, the president of the company cannot make it go, unless you do your part, and upon you in the long run, will rest the credit or the blame for the character of results."

The Analysis of Sulphur Forms in Coal

(*Continued from page* 449.)

was it necessary first to extract with phenol, then with dilute nitric acid, to remove the inorganic sulphur, and then to finish the analysis for the humus type of organic sulphur by itself.

It was found that the residue from the dilute nitric acid extraction did not go into solution in the ammonia readily, hence this residue was treated further with concentrated nitric acid. The nitric acid was then evaporated off on the water bath, leaving the residue in such a condition that it dissolved easily in ammonia. For a semibituminous coal from the Pocahontas field, three treatments with nitric acid, followed each time by evaporation on the water bath, were necessary to digest the coal sufficiently for the alkaline solution.

The residues were then treated with 25 c.c. of concentrated aqua ammonia and allowed to stand for some time. They were then filtered through an ordinary paper filter, the filtration requiring about one week on account of the colloidal nature of the solution. Previous research had shown that this alkaline soluble material was almost ash free and therefore organic in nature. Most of the ash of the coal was left on the filter.

The dark brown, colloidal solution was evaporated to dryness on the water bath and the sulphur in the residue determined by the Eschka method. This, then, gave the total organic sulphur content of the coal by a direct procedure, unless the coal had been extracted previously with phenol, in which case the above process gave the humus type of organic sulphur by itself.

The above procedure showed whether or not the methods of analysis for the various forms of sulphur in the coal were accurate, and the only question remaining was as to the possible existence of any other form of sulphur in the particular coal studied. This was easily determined by adding together the percentages of the forms of sulphur for which analyses had been run and observing how this checked with the total sulphur of the coal as determined.

Results of the Experiments—Direct Determination of Sulphate and Pyrites Sulphur and of Organic Sulphur by Difference

The first set of experiments was performed with regard to the analysis of the sulphate and pyritic forms of the sulphur alone, a detailed study of the organic sulphur being postponed until later. The data from these experiments are given in the following tables:

Sulphur and Iron in Coal No. 23066, Upper Freeport Bed, Chicora, Pa.

Constituents	Per Cent	Per Cent
Total sulphur, as determined.....	1.21	
Sulphur soluble in dilute nitric acid	.54	
Sulphur soluble in dilute hydrochloric acid	.07	
Pyritic sulphur, by direct extraction		0.47
Iron soluble in dilute nitric acid...	.52	
Iron soluble in dilute hydrochloric acid	.14	
Pyritic iron, by direct extraction...	.38	
Pyritic sulphur, calculated from iron		.44
Difference of pyritic sulphur value from calculation.....		+.03

The check on the method for pyritic sulphur in this coal is fairly close, although a very small quantity of organic sulphur may have been taken into solution.

Sulphur and Iron in Coal No. 18847, Experimental Mine, Bruceton, Pa.

Constituents	Per Cent	Per Cent
Total sulphur, as determined.....	1.72	
Sulphur soluble in dilute nitric acid	1.02	
Sulphur soluble in dilute hydrochloric acid	.23	
Pyritic sulphur, by direct extraction		0.79
Iron soluble in dilute nitric acid...	1.05	

Iron soluble in dilute hydrochloric acid	.37	
Pyritic iron, by direct extraction	.68	
Pyritic sulphur, calculated from iron		.78
Difference of pyritic sulphur value from calculation		+.01

Sulphur and Iron in Coal No. 20507, Mine No. 7, Switchback, W. Va.

Constituents	Per Cent	Per Cent
Total sulphur, as determined	0.56	
Sulphur soluble in dilute nitric acid	.09	
Sulphur soluble in dilute hydrochloric acid	.01	
Pyritic sulphur, by direct extraction		0.08
Iron soluble in dilute nitric acid	.03	
Iron soluble in dilute hydrochloric acid	.35	
Pyritic iron, by direct extraction	.08	
Pyritic sulphur, calculated from iron		.09
Difference of pyritic sulphur value from calculation		—.01

Sulphur and Iron in Coal No. 21308, Mine 301, Fleming, Ky.

Constituents	Per Cent	Per Cent
Total sulphur, as determined	0.71	
Sulphur soluble in dilute nitric acid	.17	
Sulphur soluble in dilute hydrochloric acid	.04	
Pyritic sulphur, by direct extraction		0.13
Iron soluble in dilute nitric acid	.32	
Iron soluble in dilute hydrochloric acid	.20	
Pyritic iron, by direct extraction	.12	
Pyritic sulphur, calculated from iron		.14
Difference of pyritic sulphur value from calculation		—.01

Sulphur and Iron in Coal No. 21100, Conger Mine, Coalfield, Tenn. (First Run)

Constituents	Per Cent	Per Cent
Total sulphur, as determined	4.25	
Sulphur soluble in dilute nitric acid	2.64	
Sulphur soluble in dilute hydrochloric acid	.71	
Pyritic sulphur, by direct extraction		1.93
Iron soluble in dilute nitric acid	2.49	
Iron soluble in dilute hydrochloric acid	.94	
Pyritic iron, by direct extraction	1.55	
Pyritic sulphur, calculated from iron		1.77
Difference of pyritic sulphur value from calculation		+.16

These results seemed to indicate that the organic sulphur was being attacked to some extent by the dilute nitric acid. In order to avoid this, a run was made in which the time of extraction was carefully limited to twenty-four hours only. Despite this change in the procedure, similar results were obtained, showing that this particular coal contained a small quantity of organic sulphur, which was easily oxdized and taken into solution.

The form of coal sulphur which is most likely to react in this manner is that part of the organic sulphur soluble in phenol, since the phenol insoluble organic sulphur compounds are very stable: therefore samples of the coal were first extracted with phenol, in order to dispose of these less stable organic sulphur compounds, and the residue extracted with dilute nitric acid as before. The results are given below:

Sulphur and Iron in Coal No. 21100, Conger Mine, Coalfield, Tenn. (Final Run)

Constituents	Per Cent	Per Cent
Total sulphur, as determined	4.25	
Sulphur soluble in dilute nitric acid	2.46	
Sulphur soluble in dilute hydrochloric acid	.71	
Pyritic sulphur, by direct extraction		1.75
Iron soluble in dilute nitric acid	2.48	
Iron soluble in dilute hydrochloric acid	.94	
Pyritic iron, by direct extraction	1.54	
Pyritic sulphur, calculated from iron		1.76
Difference of pyritic sulphur value from calculation		—.01

This run showed that some of the organic sulphur had been taken into solution by the dilute nitric acid, demonstrating clearly the necessity for check determinations on the iron content of nitric acid extracts of coal.

Sulphur and Iron in Coal No. 27224, Mayer No. 9 Mine, Carona, Kan.

Constituents	Per Cent	Per Cent
Total sulphur, as determined	3.06	
Sulphur soluble in dilute nitric acid	2.31	
Sulphur soluble in dilute hydrochloric acid	.32	
Pyritic sulphur, by direct extraction		1.99
Iron soluble in dilute nitric acid	2.25	
Iron soluble in dilute hydrochloric acid	.49	
Pyritic iron, by direct extraction	1.76	
Pyritic sulphur, calculated from iron		2.01
Difference of pyritic sulphur value from calculation		—.02

It will be noticed that the analytical results for pyritic sulphur in all six of the coals tested check to within a reasonable experimental error. The summarized results of these analyses for sulphur forms in the coals are given in the following table. It is to be noted that the organic sulphur values are obtained by difference, as they would be in actual laboratory practice.

Table 3—Summary of Direct Analyses for Sulphur Forms in Coal*

Laboratory Number	Source (State)	Total	Pyritic	Sulphate	Organic
23066...	Pennsylvania ...	1.21	0.47	0.07	0.67
18847...	Pennsylvania ...	1.72	.79	.23	.70
20507...	West Virginia ..	.56	.08	.01	.47
21308...	Kentucky	.71	.13	.04	.54
21100...	Tennessee	4.25	1.75	.71	1.79
27224...	Kansas	3.06	1.99	.32	.75

*Values given in per cents, air-dry basis.

Freshly mined coal seldom contains any appreciable amount of sulphates. The comparatively large percentages shown in the above coals are due to the fact that all had stood in the sample room for several years before the experiments were performed. Since this investigation endeavored to verify the method of analysis rather than to indicate the nature of any set of coals, this aging of the coals was a decided advantage, in that it gave an appreciable amount of the sulphate form.

Direct Determination of Organic Sulphur Forms

It was now necessary to prove by actual experiment that the sulphur assumed to be organically combined was entirely in this form. The results on the phenol soluble type of organic sulphur were as follows:

Phenol Soluble Organic Sulphur in Coals

Coal Samples Laboratory Number	Source (State)	Per Cent
23066.....	Pennsylvania	0.12
18847.....	Pennsylvania	.20
20507.....	West Virginia	.02
21308.....	Kentucky	.09
21100.....	Tennessee	.77
27224.....	Kansas	.32

The results for the other type of organic coal sulphur, the so-called humus organic sulphur, are given below. This is the sulphur existing in compounds insoluble in phenol, very stable, and taken into solution only by treatment with concentrated nitric acid, followed by extraction with strong aqua ammonia. Except in the case of the Tennessee coal, the figures below were obtained by subtracting the phenol soluble sulphur from the total organic sulphur. As mentioned previously, the Tennessee coal was first extracted with phenol; hence, the final ammonia soluble fraction contained only the humus type of organic sulphur, which was thus given directly.

"Humus" Type of Organic Sulphur in Coals

Coal Samples Laboratory Number	Source (State)	Per Cent
23066.....	Pennsylvania	0.50
18847.....	Pennsylvania	.46
20507.....	West Virginia	.44
21100.....	Tennessee	1.01
27224.....	Kansas	.39

Summary of Analytical Results

The following table gives in condensed form the results of the analyses for the various forms of sulphur and a comparison of the total of these with the total sulphur of the coal:

Table 4—Summary of All Analyses for Sulphur Forms in Coal

Sulphur Forms	Coal Samples No. 23066 (Pa.)	No. 18847 (Pa.)	No. 20507 (W. Va.)	No. 21308 (Ky.)	No. 21100 (Tenn.)	No. 27224 (Kans.)
Pyritic sulphur	0.47	0.79	0.08	0.13	1.75	1.99
Sulphate sulphur	.07	.23	.01	.04	.71	.32
Humus organic sulphur	.50	.46	.44	.42	1.01	.39
Phenol soluble organic sulphur	.12	.20	.02	.09	.77	.32
Total	1.16	1.68	.55	.68	4.24	3.02
Total by direct analysis	1.21	1.72	.56	.71	4.25	3.06
Difference between totals	.05	.04	.01	.03	.01	.04

It is evident from this table that the sum of the several analyses checks very closely with the total sulphur content of each coal. There can be no doubt, therefore, but that all the sulphur of these coals has been accounted for in the four forms—namely, pyritic, sulphate, phenol soluble organic sulphur, and phenol insoluble organic or humus sulphur.

A graphic representation of the results of these experiments is given in figure 1. This shows the relative quantities of the various sulphur forms in the coals, a comparison with total sulphur, and a comparison of the pyritic sulphur as obtained with the pyritic sulphur as calculated from the pyritic iron.

Methods for the Analysis of Sulphur Forms in Coal

For laboratory practice the following methods are suggested for the analysis of the sulphur forms in coal. These methods are essentially those suggested earlier by Powell and Parr, but a few changes are introduced, which, it is hoped, will make the process better adapted to commercial laboratory routine.

Three methods of analysis are given. The first is to be used where only the sulphate, pyritic, and total organic sulphur are desired. The second is to be used where the two forms of organic sulphur are to be determined separately. The third is the method which has been followed in the present investigation—a complete, direct analysis of every sulphur form and a basic check on the method of analysis. This

latter method would find use only where a coal from a new field was being studied.

A—Rapid Method for Sulphate, Pyrites, and Total Organic Sulphur

Crush the air-dried coal so that it will pass completely through a 100-mesh screen. Weigh out a five-gram sample and place it in a 500-c.c. beaker. Cover this carefully with 300 c.c. of 3 per cent hydrochloric acid, stir thoroughly, and place a watch glass on the beaker. Put this beaker on top of a water bath or some other warm place where it can digest at about 60 deg. Cent.

At the end of forty hours filter the contents of the beaker, discarding the coal material left on the filter. Add 2 c.c. of bromine water and heat almost to boiling. Pour this acid solution into an excess of ammonia and stir to coagulate the ferric hydroxide. Filter off this iron precipitate, retaining it for the iron determination later. Make the filtrate barely acid with hydrochloric acid, heat to boiling, and add slowly, with stirring, 10 c.c. of 10 per cent barium chloride Allow this to stand for several hours, then filter it. Ignite the filter paper and weigh the precipitate of barium sulphate. The weight of barium sulphate, in grams, multiplied by 2.75, represents the percentage of sulphur, combined as sulphate, in the coal.

Dissolve the precipitate of ferric hydroxide off the filter with concentrated hydrochloric acid. Heat this acid solution to boiling and then add drop by drop, until colorless, a solution of stannous chloride (50 grams of stannous chloride and 100 c.c. of concentrated hydrochloric acid, diluted to 1 liter). Allow the solution to cool; then add 25 c.c. of a saturated solution of mercuric chloride, stirring thoroughly. Now dilute the contents of the beaker to 500 c.c. and add 20 c.c. of manganese sulphate solution (67 grams of crystallized manganous sulphate, 138 c.c. of phosphoric acid, specific gravity 1.7, and 130 c.c. of concentrated sulphuric acid, made up to 1 liter of solution). Titrate this solution with N/50 potassium permanganate to the faintest noticeable pink color. The number of cubic centimeters of N/50 potassium permanganate used, multipled by 0.0223, gives the percentage of hydrochloric-acid soluble iron in the coal.

Now weigh out a one-gram sample of the coal and place it in a 150-c.c. beaker. Cover it with 84 c.c. of dilute nitric acid (one part of nitric acid, specific gravity 1.42, to three parts of water; specific gravity of mixture, 1.12). Allow this to stand for twenty-four hours, with occasional stirring, and filter. Discard the coal residue on the filter. Add 2 c.c. of concentrated hydrochloric acid to the filtrate and evaporate to dryness on the water bath. Dissolve the residue in 25 c.c. of water and 5 c.c. of concentrated hydrochloric acid. Pour this acid solution into an excess of hot, dilute ammonia. From this pont the analysis is the same as that for the hydrochloric-acid soluble iron and sulphur. The weight of barium sulphate, in grams, multiplied by 13.75, represents the percentage of sulphur, both pyritic and sulphate, in the coal. The number of cubic centimeters of N/50 potassium permanganate used multiplied by 0.1115 gives the percentage of iron, both pyritic and acid soluble, in the coal.

Figure the percentage of pyritic sulphur in the coal by subtracting from the percentage of sulphur obtained the percentage of sulphate sulphur. Also, as a check, subtract from the percentage of iron obtained the percentage of hydrochloric-acid soluble iron, multiply the result by 1.145, and note how it compares with the percentage of pyritic sulphur. If this calculated percentage is lower than that obtained directly, the calculated value should be considered the correct one. In fact, it would seem safe, for rapid analytical work, to calculate the pyritic sulphur from the iron in every case. This method of procedure would eliminate the sulphur determination on the nitric-acid extract, thereby saving considerable analytical work.

Commercial laboratories would probably find a saving of time for acid extractions if some type of shaking device were used. By this the time of extraction could probably be cut down to an hour for the nitric acid.

Calculate the total organic sulphur of the coal by adding the percentages of sulphate and pyritic sulphur and subtracting this from the per cent of total sulphur in the coal. The investigation has shown that this sulphur may safely be considered organic.

B—Method for Sulphate, Pyrites, and Two Forms of Organic Sulphur

This method involves exactly the same procedure as method A, but another determination is added. Weigh one gram of the coal into a 50-c.c. Erlenmeyer flask. This should be fitted with a cork stopper, through which is inserted a straight glass tube about two feet long. Twenty-five cubic centimeters of melted phenol is then poured into the flask, the stopper with the glass tube inserted, and the flask placed in an electric oven that maintains a temperature of 150 deg. Cent. The glass tube should be so arranged that it protrudes from the oven into the room in order that it may act as a condenser for the phenol vapors.

At the end of twenty hours the flask is removed and the contents filtered, while hot, through a Gooch crucible. The residue is completely washed out of the flask into the crucible with alcohol and the washing with alcohol is continued until the alcohol runs through colorless. The residue is then washed with a small amount of ether and placed in an oven to dry The residue, together with the asbestos mat, is completely removed from the crucible and ground in a mortar with twice its volume of Eschka mixture (one part of sodium carbonate and two parts of calcined magnesia). This mixture is then placed in a porcelain crucible, covered with more of the Eschka mixture, and heated to a low red heat in a muffle or over a sulphur-free flame. After complete combustion of the coal residue the contents of the crucible are dissolved in hydrochloric acid, to which a little bromine water has been added. This solution is filtered and made alkaline with ammonia, then acidified slightly with hydrochloric acid. The sulphur is precipitated and determined as in method A. After the blank due to the Eschka mixture is subtracted the weight of barium sulphate, in grams, multiplied by 13.75 represents the percentage of sulphur insoluble in phenol. The percentage of phenol soluble organic sulphur is calculated by subtracting this from the per cent of total sulphur. The percentage of humus organic sul-

phur is calculated by subtracting the phenol soluble sulphur from the total organic sulphur

C—Detailed Method for Direct Determination and Study of All Sulphur Forms in Coal

This involves the same procedure used in method B, but an extra determination is required. It is a direct estimation of the total organic sulphur, which in the other methods was found by difference. Take the residue from the dilute nitric acid extraction, including the filter paper, and place it in a small beaker Cover this with concentrated nitric acid and place on a water bath to digest, leaving it there until the nitric acid has entirely evaporated. In the case of coals tending toward the semibituminous character, the treatment should be repeated several times.

Pour over the dry residue 25 c.c. of concentrated ammonia and stir thoroughly. Dilute somewhat and filter the solution through an ordinary filter paper. This filtration will probably require several days. Evaporate the dark brown filtrate to dryness on the water bath and remove the residue with a spatula. Grind this with the Eschka mixture, as described under method B, and determine the sulphur in the same manner. After subtracting the blank due to the Eschka mixture the weight of barium sulphate, in grams, multiplied by 13.75, represents the percentage of total organic sulphur in the coal. If the coal is normal, this percentage should check fairly close to the percentage of total organic sulphur obtained by difference.

Conclusions

1. The method of Powell and Parr gives correct and accurate results for the analysis of sulphur forms in coal, as proved by experiments on a variety of coals from different fields. Detailed laboratory procedure methods are given in this paper.

2. Dilute nitric acid will extract small amounts of organic sulphur from certain coals. The organic sulphur extracted is the unstable phenol soluble form. In order to avoid this error in laboratory determinations, it is recommended that the pyritic sulphur be calculated from the pyritic iron value.

3. The acid extractions of the coal can probably be materially shortened by using a shaking machine.

4. The dilute nitric acid not only extracts the pyrites quantitatively but also the same iron and sulphur taken into solution by dilute hydrochloric acid. For this reason samples intended for dilute nitric-acid extraction do not need to be extracted first with hydrochloric acid.

5. Semibituminous coals and the harder varieties of bituminous coals must be digested for a long time with concentrated nitric acid before the organic matter will become completely soluble in ammonia.

6. The Eschka method is preferable to the sodium peroxide method for the analysis of the sulphur in the coal and the coal residues unless the sodium peroxide used has a low and constant sulphur content.

New York Consolidated Gas Company Reduces Rates

(*Continued from page* 450.)

time and will be at least $1.25 per thousand cubic feet under the new prices for gas oil, after August 1.

"As to the New York Mutual Gas Light Company, the New Amsterdam Gas Company, the Standard Gas Light Company, and the East River Gas Company of Long Island City, whose rate cases are nearing the stage of final decree, those companies will expect, upon the entry of such decrees, to put in force the rate then shown to be required. Under temporary injunctions granted by this court these companies are now permitted to charge $1.20 per thousand cubic feet, which does not quite pay actual operating costs, without any return on investment in the property used in serving the public. That is because the court refused to allow a rate yielding return on investment to be charged until we had established, by full hearing and proof, our right to a final decree and an adequate rate. If, as now expected, final decrees are entered before the expiration of the present oil contract, that will mean a rate of $1.50 for those companies until the new oil contract goes into effect, when it will be reduced to a $1.25 maximum.

"As to the Bronx Gas & Electric Company, which is now charging $1.50 per thousand cubic feet pursuant to temporary injunction granted by the State court, it continues true that the $1.50 rate does not, in the sparsely developed territory of that company, reimburse the company for its actual operating costs and yields nothing by way of return on property investment. The approaching reduction in the cost of gas oil will not, therefore, enable such a reduction to be made in the gas rate of the Bronx Gas & Electric Company as is announced with respect to the Consolidated Gas Company.

"As to the New York & Queens Gas Company, the situation as to the adequacy of its present rate of $1.25 per thousand cubic feet plus a service charge of 75 cents per month, is similar. That rate is not now meeting operating costs, and the company is not earning a fair return or any return on its actual investment as found by the special master of the Federal court, after full hearing. The approaching decrease in the cost of gas oil will not, therefore, enable a reduction to be made in the rate of the New York & Queens Gas Company. The existing rate will probably have to be increased to the point of adequacy, in the near future. Thereafter reduction will be made just as soon as and just as far as the operating costs of this suburban company permit.

"The books and records of this company and its affiliated companies have been found by the various courts to show accurately and fairly the cost of making and distributing gas. We desire to charge only a rate which will at all times defray those costs and yield a fair return on our invested capital. We shall expect, under the supervision of the Public Service Commission, to decrease or increase our rates from time to time to prevent them from becoming either too high or too low.

"The patience and fairness of the company's consumers in meeting the existing situation with equanimity adds to the pleasure of the company in being able to announce an early and substantial reduction.

"With respect to suggestions that have been made as to the desirability of gradations in the basis of rates for gas I may add that within the limits required for adequacy of revenue, the interests of these companies are identical with those of its consumers and the entire community, and these companies will be best satisfied with the form of rate structure which, after full consideration of the public interest, is found to meet most fairly the requirements of the enterprises and consumers dependent on gas service. Under the recent amendments of the Public Service Commissions law, any such changes in rate structure may become effective only with the approval of the new Public Service Commission."

Public Utilities Securities Market Report

Prices of Representative Gas Bonds

(Quotations furnished by The National City Company)

Company	Issue	Maturity		—Market— May 19, 1921 Bid	Asked
American Lt. & Trac. Co.	Five Year 6s	May	1, 1925	88	89
Brooklyn Union Gas Co.	First Consol. 5s	May	1, 1945	78	80
Columbia Gas & Elec. Co.	First 5s	Jan.	1, 1972	83½	84½
Consol. Gas, Elec. Lt. & Pr. Co. of Baltimore	First Ref. 7½s	Dec.	1, 1945	98½	99½
Consol. Gas, Elec. Lt. & Pr. Co.	General 4½s	Feb.	14, 1935	75	75¾
Consol. Gas Co. of New York	Sec. Conv. 7s	Feb.	1, 1925	101¾	102¼
Consol. Gas Co. of New York	One Year Sec. 8s	Dec.	1, 1921	100	100⅜
New Amsterdam Gas Co.	First Consol. 5s	Jan.	1, 1948	62	65
Denver Gas & Elec. Co.	Gen. (now 1st) 5s	May	1, 1949	80½	82
Detroit City Gas Co.	Gold 5s	Jan.	1, 1923	91	93
Equitable Illum. Gas Lt. Co. of Philadelphia	First 5s	Jan.	1, 1928	94	95½
Hudson County Gas Co.	First 5s	Nov.	1, 1949	73	76
Laclede Gas Light Co.	Ref. & Ext. 5s	Apr.	1, 1934	73½	75½
Louisville Gas & Elec. Co.	First & Ref. 7s	June	1, 1923	94	95¼
Michigan Light Co.	First & Ref. 5s	Mar.	1, 1946	70	75
Milwaukee Gas Light Co.	First 4s	May	1, 1927	80	81½
Pacific Gas & Elec. Co.	Gen. & Ref. 5s	Jan	1, 1942	77	78
Pacific Gas & Elec. Co.	Col. Tr. Conv. 7s	May	1, 1925	95	97
Pacific Gas & Elec. Co.	First & Ref. 7s	Dec.	1, 1940	98	99
Cal. Gas & Elec. Corp.	Unif. & Ref. 5s	Nov.	1, 1937	86¼	87
Peoples' Gas Lt. & Coke Co.	Refunding 5s	Sept.	1, 1947	73	74½
Chicago Gas Lt. & Coke Co.	First 5s	July	1, 1937	74	77
Portland Gas & Coke Co.	First & Ref. 5s	Jan.	1, 1940	75	77
Seattle Lighting Co.	Refunding 5s	Oct.	1, 1949	66	68
Southern California Gas Co.	First 6s	Nov.	1, 1950	84	86
United Gas Improvement Co.	Two Year 8s	Feb.	1, 1923	98¼	99
Utica Gas & Electric Co.	Ref. & Ext. 5s	July	1, 1957	76	78
Washington Gas Light Co.	General 5s	Nov	1, 1960	78	79
Western States Gas & Elec. Co. of California	First & Ref. 5s	June	1, 1941	75	77½

Shrinkage in Earnings of the Portland Gas & Coke Co.

Net earnings of the Portland Gas & Coke Company for March were 24 per cent lower than for the corresponding month of last year, while for the twelve months to the end of March the decrease in net was 2 per cent. Operating expenses for March were 112 per cent more than in March of last year and the gross earnings were 64 per cent higher.

Following is a summary of the report to share and bond holders:

	March, 1921	Twelve Mos.
Gross earnings	$327,960	$2,946,427
Operating expenses	267,646	1,981,909
Net earnings	$ 60,314	$ 964,518
Balance after deducing fixed charges	$ 22,397	$ 578,665

Gas Bonds Called

San Diego Consolidated Gas & Electric Company's 6 per cent debentures, due Dec. 1, 1922, of which there are $839,000 outstanding, have been called for payment June 1, 1921, at 101, according to C. H. Richey of Blythe, Witter & Co. It is asserted that new financing is contemplated, but the amount, character or rate of new securities have not yet been made public.

During the ten years ending 1920 the population of San Diego increased 88 per cent, which rate was exceeded by only one other city in California. This rapid development called for a corresponding increase in the business of the San Diego Gas & Electric Company, which, it is confidently expected, will continue throughout the coming year.

La Crosse Appeal Dismissed

Madison, Wis.—Complaint of the city of La Crosse over its gas rates was dismissed May 5 by the railway commission in an order. The present rate of $2.05 net per 1,000 ft. is held to be reasonable under existing conditions.

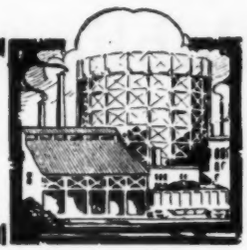
Gas Company Asks Increase

The Trinidad (Col.) Electric Transmission, Railway & Gas Company has asked the State Utilities Commission to either permit it a 10 per cent increase in the rate charged for gas or to allow them to discontinue the gas business. There is great objection made to the gas company's request by the Trinidad Civic Association and the citizenry.

Gas Plant Fire Causes Small Loss

Davenport, Iowa.—Minor damages were caused the Peoples Light Company's gas plant at 1125 West Second Street May 6, when escaping gas caught fire. Firemen were called and succeeded in checking the blaze before it had an opportunity to spread. Company officials said the loss was small.

NEWS OF THE GAS INDUSTRY



Reduce Gas Rate 3 Cents

Minneapolis, Minn.—A new gas rate of $1.28, a reduction of 3 cents from the present rate, went into effect in Minneapolis May 1 for the four months' period ending August 31.

The reduction is made in conformity with a decision of the United States district court, that the gas rate in the city shall be determined by the cost of service, plus a fair return on the investment. Minneapolis' gas bill for the period will thus be reduced $30,000, or an average saving of 33 cents a meter to the consumers of Minneapolis, Gas Light Company officials declared.

A still further reduction is predicted for the next four months' period, beginning September 1.

The price of coal and oil will be the principal factors in determining the fall rate, and while there is no definite indication as to how far gas coal is going to drop at the present time, some reduction is said to be almost certain.

The rate for each four months' period is determined, company officials pointed out, by the cost of service during a period of equal length, ending two months before the price period begins. For example, the cost period which brought the 3-cent reduction was from November 1 to February 28, while the period from March 1 to June 30 will determine the price to be charged from September 1 to December 30.

The present rate of $1.31 was set by the United States district court last July.

While reduction in the price of gas and oil have both aided materially in bringing the 3-cent reduction, the greatest factor has been the oil. Gas oil, which furnishes over 75 per cent of the city's gas, has declined approximately 30 per cent in price during the past six months. The full weight of this reduction will be felt in the gas rate for September 1.

"Gas rates, which are dependent in coal and gas oil must necessarily fluctuate with the cost of these products," E. W. Brace, secretary of the gas company, said. "When the new rates for September 1 are set they will show a material reduction, according to present indications."

Company Has Big Program of Construction

San Diego, Cal.—The San Diego Consolidated Gas & Electric Company plans a large construction program during the present year, according to Manager H. H. Jones, and stockholders of the corporation are called to a special meeting June 21 to authorize a first and refunding mortgage bond issue for the purpose.

Continued rapid growth of San Diego and vicinity and the substantially increasing demand for additional electric and gas service were said by Mr. Jones to make a big construction program necessary. The first mortgage under which outstanding bonds of the company are issued is practically closed, preventing issue of additional bonds by its authority, and the new mortgage is deemed entirely practical, in view of the company's high financial standing and increasing business.

Included in the purposes of the new bonds for improvement is completion of financing the purchase of the power plant of the San Diego Electric Railway, which will add 14,000 h.p. of electrical generating capacity. Some of the construction planned is in connection with utilizing the full power of the plant and to operate the company's two stations economically and efficiently. A new sub-station also is planned, with extensions of the electrical distribution system that will cost $520,000.

In the gas department the manufacturing capacity is to be increased 2,700,000 ft. a day by installation of two new gas generators and incidental equipment, to cost $315,000, with improvement in the distribution system to cost about $285,000.

The mortgage bond issue which the stockholders are asked to authorize is to be in the amount of $50,000,000, but only $2,750,000 of the issue is to be placed on sale for the present. They will bear interest at the rate of 6 per cent and be due March 1, 1939. Application has been made to the State railroad commission to issue the additional securities.

An idea of the development of San Diego since 1906 is gained from figures concerning the business of the gas and electric company, exhibited by the manager. The gross earnings of the company in 1906 were $204,092.30, and in 1920, $2,661,045.93. In that period the number of electric customers increased from 2,212 to 27,763, and the number of gas customers from 4,594 to 27,188.

To Lay Two Miles of Main

Des Moines, Iowa.—The Des Moines Gas Company will lay more than two miles of gas mains in Des Moines starting immediately, H. R. Sterrett, engineer for the company, announced May 9.

These extensions will be the first to be made since the war. Materials have been so scarce and high priced that it has been advisable not to make extensions up to this time.

Various districts, in all parts of the city, will be benefited by the improvements. Districts requesting gas mains during the last three years will be given extensions according to the time of the request.

Highland Park is to receive some extensions; so is the district near the fair grounds, and practically every other part of the city.

Mr. Sterrett stated the extensions are being made at a heavy expense, the pipe costing more than three times what it did before the war. The pipe to be laid cost the company $85 a ton, while before the war the cost was $25 a ton. About 100 ft. of four-inch main weighs a ton.

A house to house canvass is also being made with the idea of improving service. A squad of men has been employed, whose duties are to clean out and put in perfect order all gas appliances.